

Staging & Construction Sequencing



Snow Lake MB

Managing Construction Site Runoff is Not an Easy Task....



- **Budgets are tight, environmental protection is often underestimated along with other “unaccounted for” variables**
- **The market is looking for a “one step solution” answer and it does not exist**
- **Enforcement is perceived as random and often unevenly distributed regionally**

Seeding

Wattle

Straw Blanket

Gravel Filter Berm

Silt Fence

Straw Mulch

What-Where-When?

Soldotna

Incorporate sediment and erosion controls to protect permanent stormwater controls as they are constructed.



What is a BMP?



- Schedule of activities** - **Prohibitions of practices**
- Physical structures** - **Construction procedures**
- Other management practices to reduce pollution**

Design BMPs

- Minimize disturbance (foot print) of project.
- Maximize integration of existing land contours.
- Minimize length and gradient of slopes.
- Account for both onsite and offsite stormwater during construction.

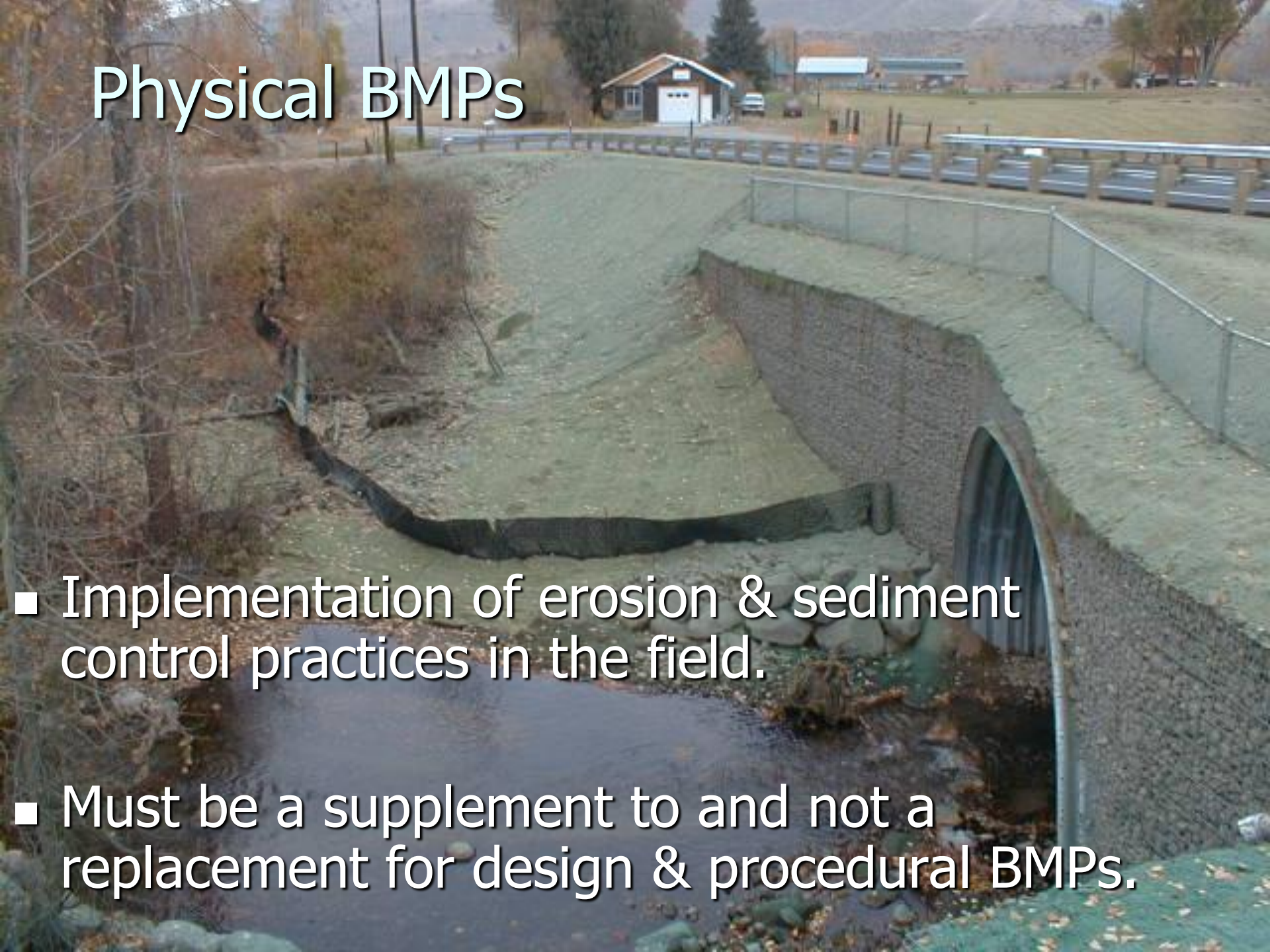
Procedural BMPs

- Time major soil disturbance for dry season
- Complete project in phases
- Integrate erosion control and construction schedules (they don't have to conflict)



Physical BMPs

- Implementation of erosion & sediment control practices in the field.
- Must be a supplement to and not a replacement for design & procedural BMPs.





NEWS FLASH

It's about
how you do,
what you do,
and when
you do it!





BMP's should meet & exceed designed performance goals or outlast the strongest, longest storm





Hummmnn....

Managing Risk



1. **Identify**
Sources of Potential Harm
2. **Develop**
Strategies to Manage Risk
3. **Implement**
Plans to Reduce or Eliminate Risk

Thanks, Leo Holm

What do we need to do to successfully deliver our projects?

- ✓ Production
- ✓ Profitability
- ✓ Compliance

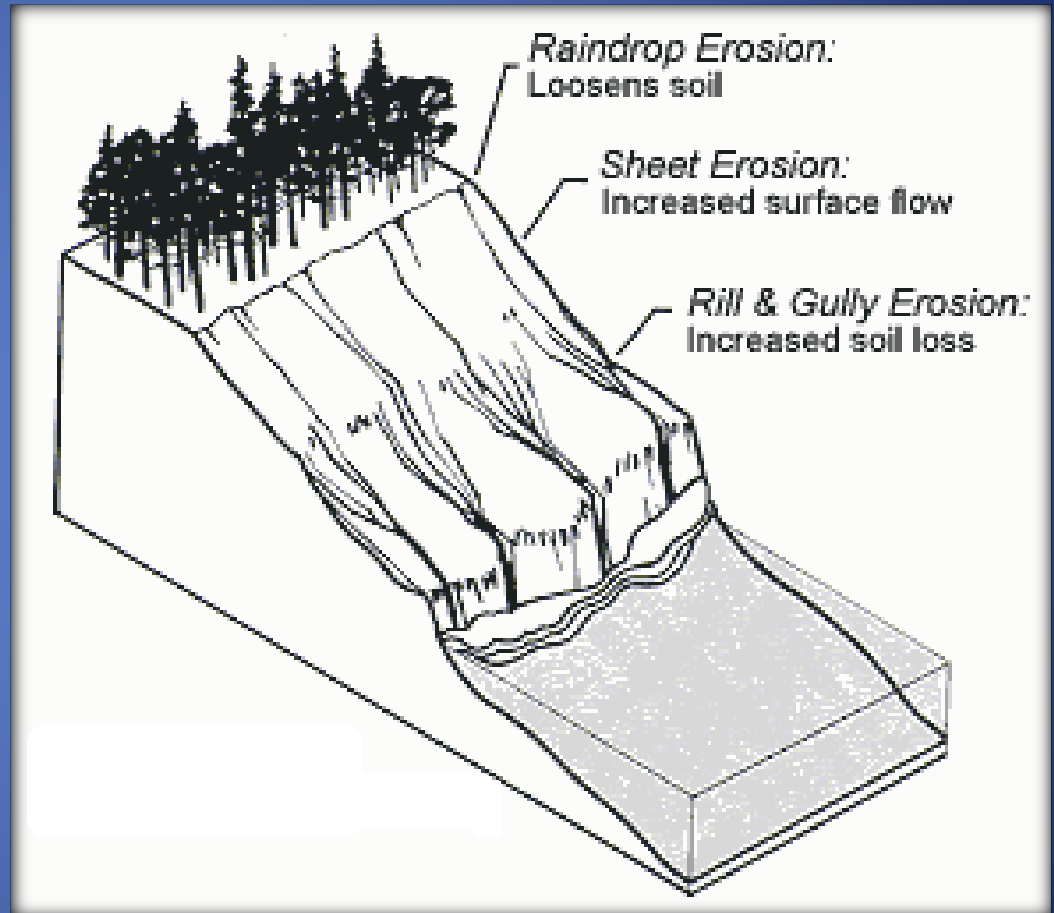


What do we need to do to succeed with erosion and sediment control?

- ✓ Stabilize Soils
- ✓ Manage Flows
- ✓ Control Sediment
- ✓ Good Housekeeping

Erosion Processes

- Raindrop
- Sheet
- Rill
- Gully
- Stream & Channel



Raindrop Impact.

Filmed at 1/240th of a second.



Stream & Channel Bank Erosion



More Volume
- Time
= More Velocity
& Scour Erosion

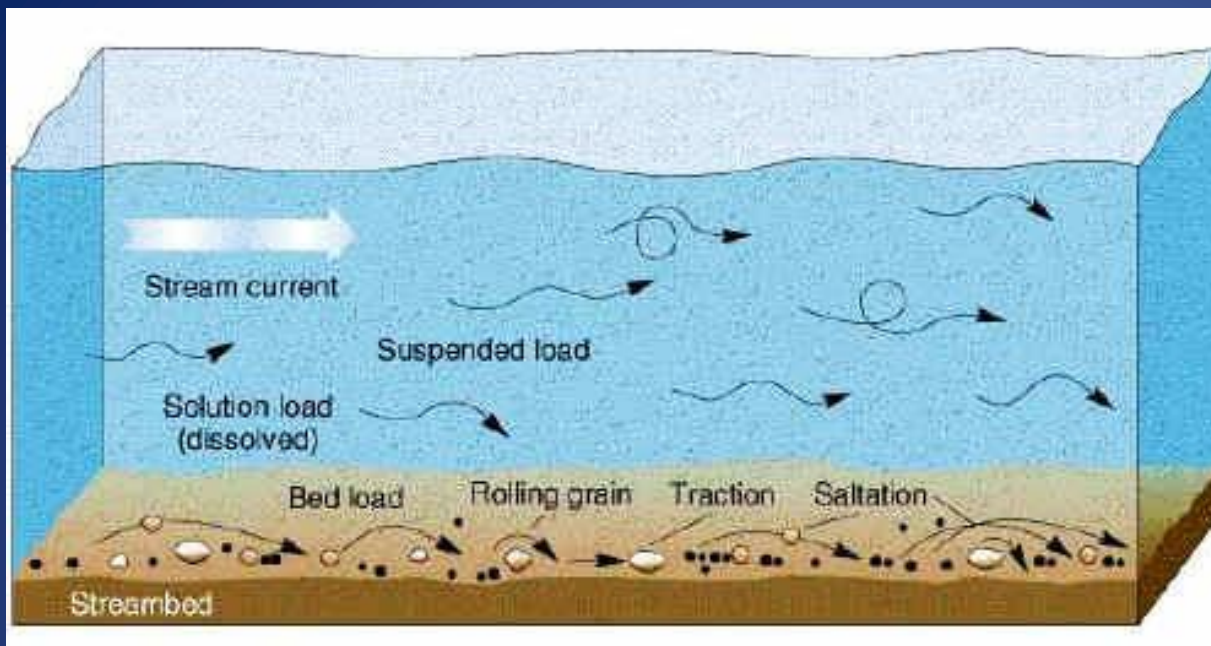
Brinnon WA

3 best ways to increase volume & velocity?

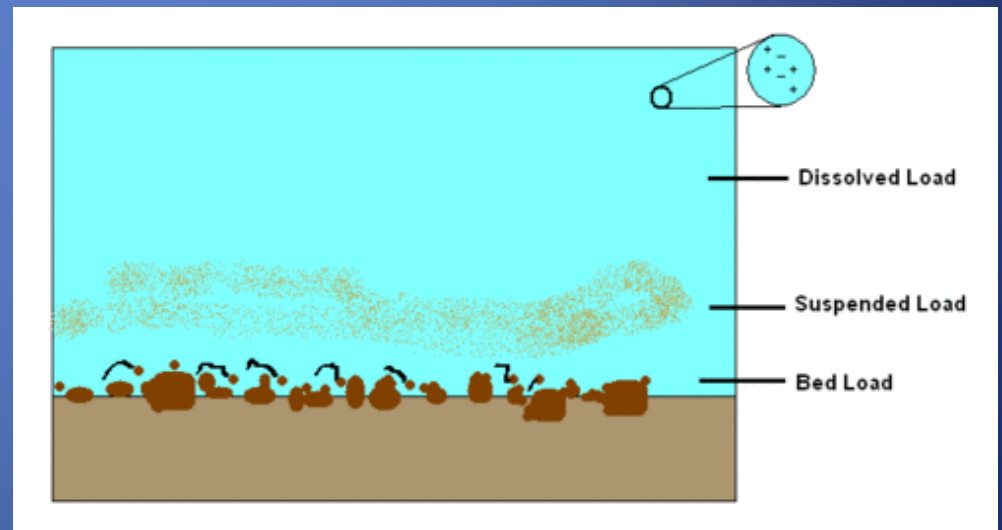
- Remove the vegetation
- Strip the topsoil
- Compact the subgrade

Construction 101





- Bed Load
- Suspension
- Colloidal Suspension

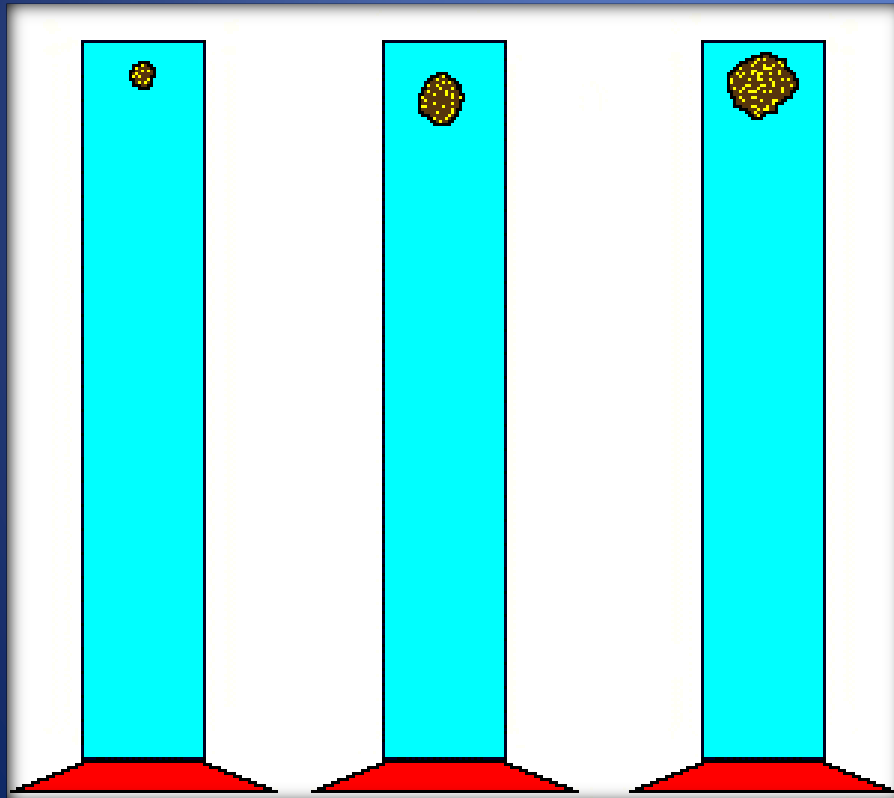


Size matters in settling time! & sediment control

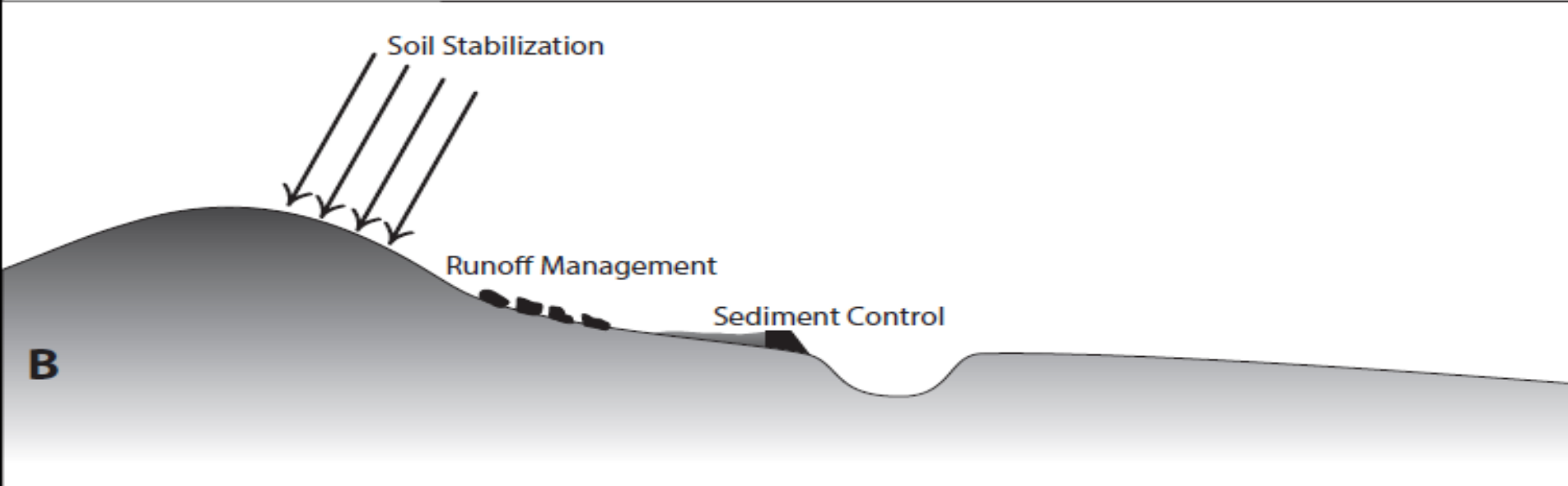
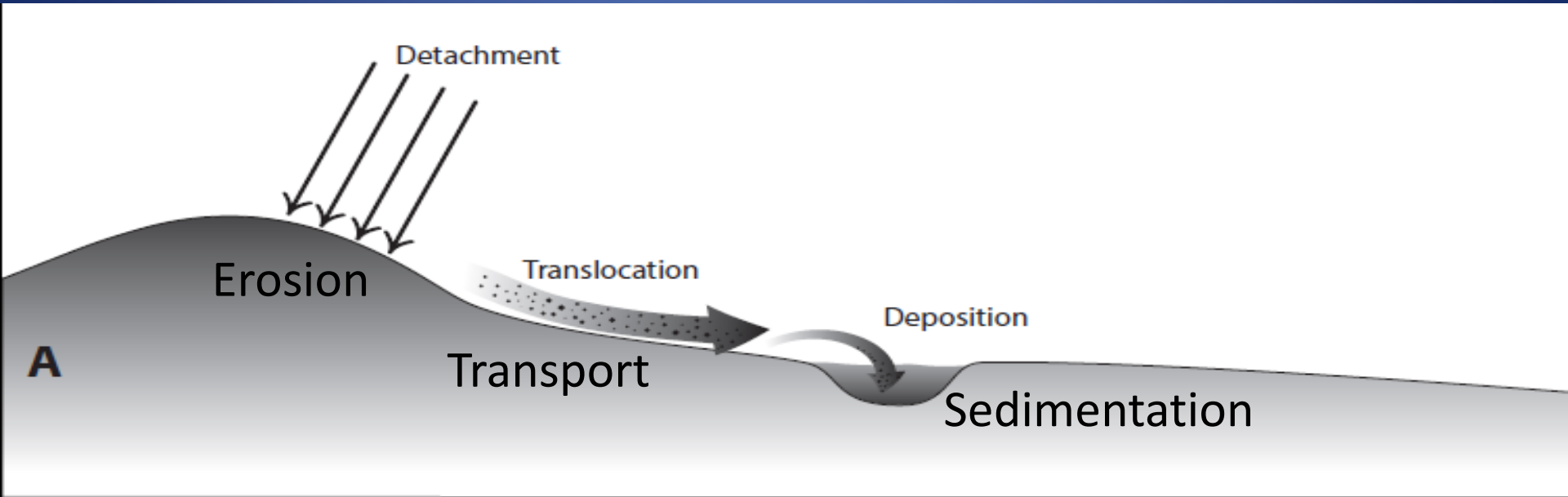
Clay

Silt

Sand



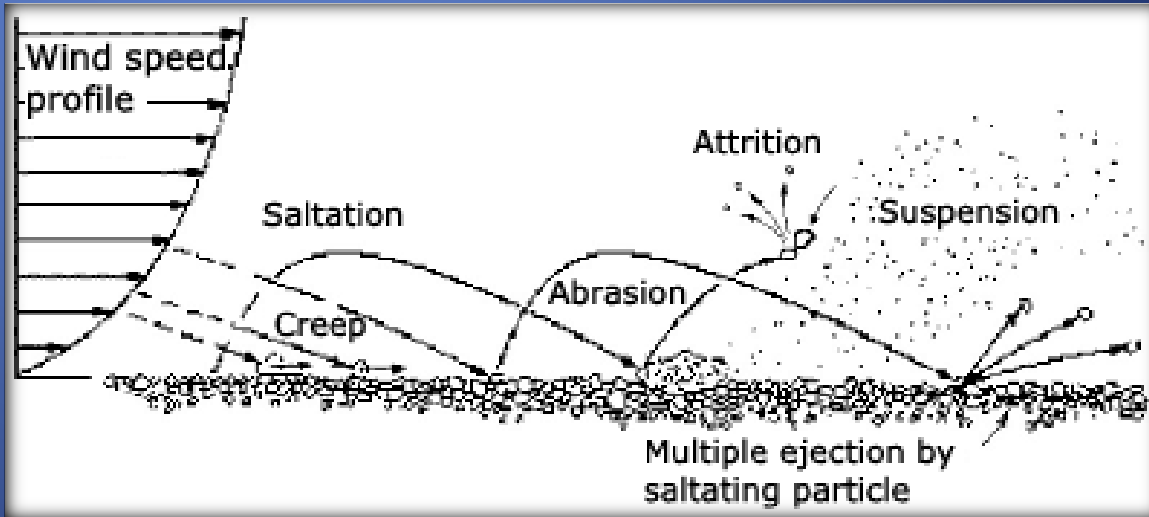
Stabilize Soils & Control the Flow



- Where will soil detach on your project?
- Where will it deposit?



Wind Erosion



Dune Sand in a Wind Tunnel



Factors That Influence Erosion

- Soils
- Precipitation
- Vegetation
- Surface Area
- Slope Length
- Slope Gradient
- Surface Texture

Soil Texture & Erodibility

A wide-angle photograph of a construction site. In the foreground, a dirt road with tire tracks leads into the distance. To the left of the road, two large, light-colored pipes are laid out. To the right, there are large mounds of dark soil. In the background, there are construction vehicles, including an excavator and a truck, and a line of trees under a cloudy sky.

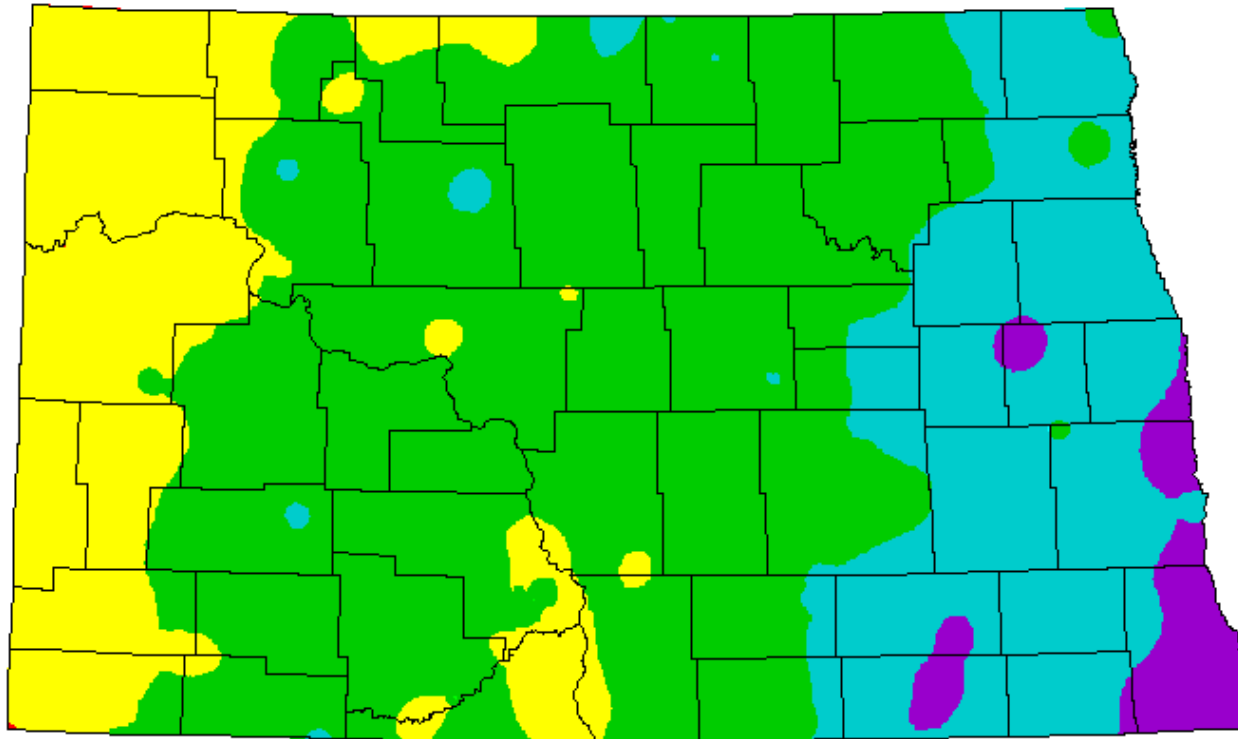
**Erodibility Increases
as the % of Silt & Sand Increases**

**Erodibility Decreases
as the % of Clay & Organic Material Increases**

Precipitation & Climate

Average Annual Precipitation

North Dakota



Legend (in inches)

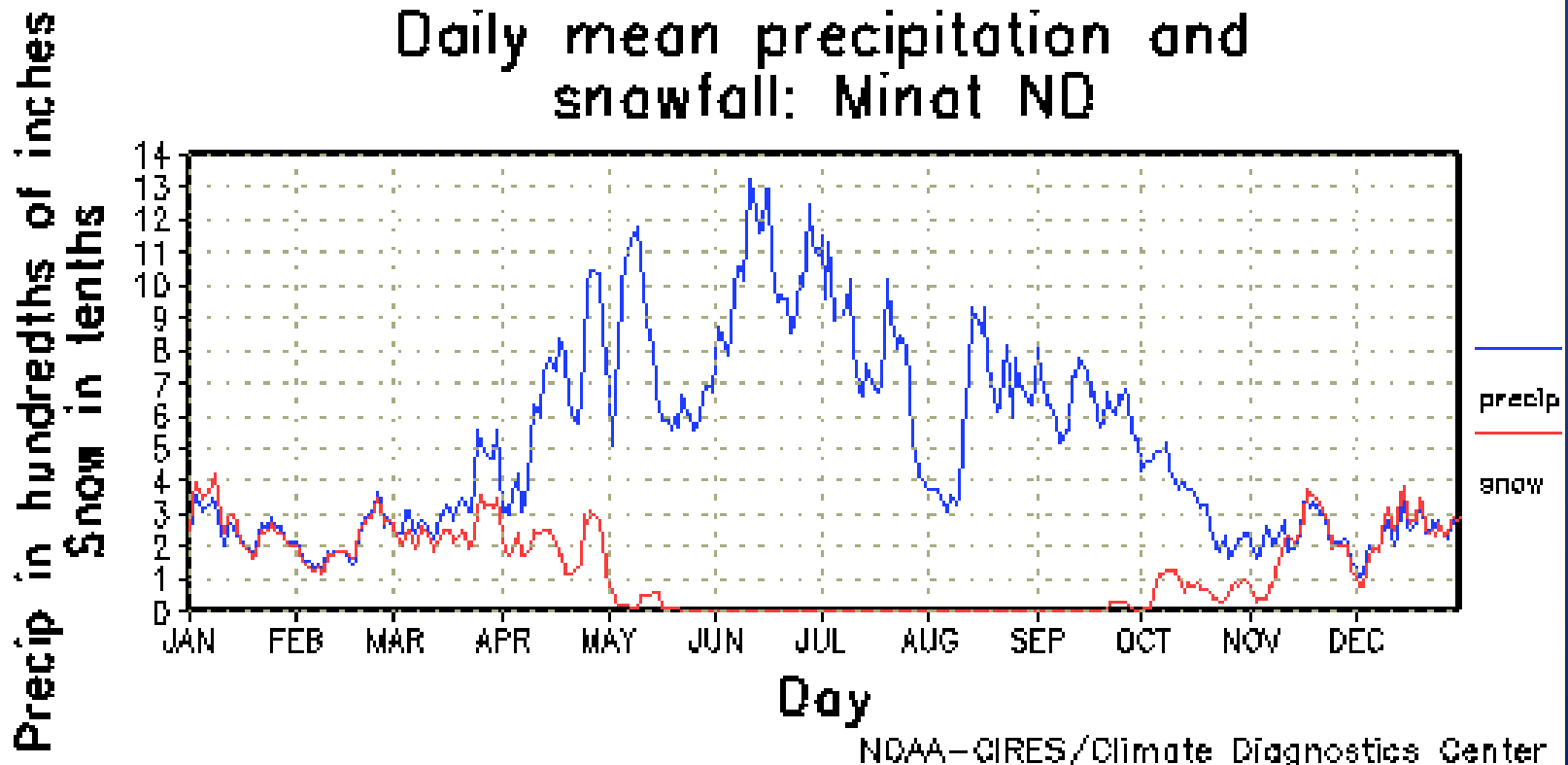
- Under 15
- 15 to 17
- 17 to 19
- Above 19

This map is a plot of 1961-1990 annual average precipitation contours from NOAA Cooperative stations and (where appropriate) NRCS SNOTEL stations. Christopher Daly used the PRISM model to generate the gridded estimates from which this map was derived; the modeled grid was approximately 4x4 km latitude/longitude, and was resampled to 2x2 km using a Gaussian filter. Mapping was performed by Jenny Weisburg. Funding was provided by NRCS Water and Climate Center.

12/7/97



Preparation & Planning

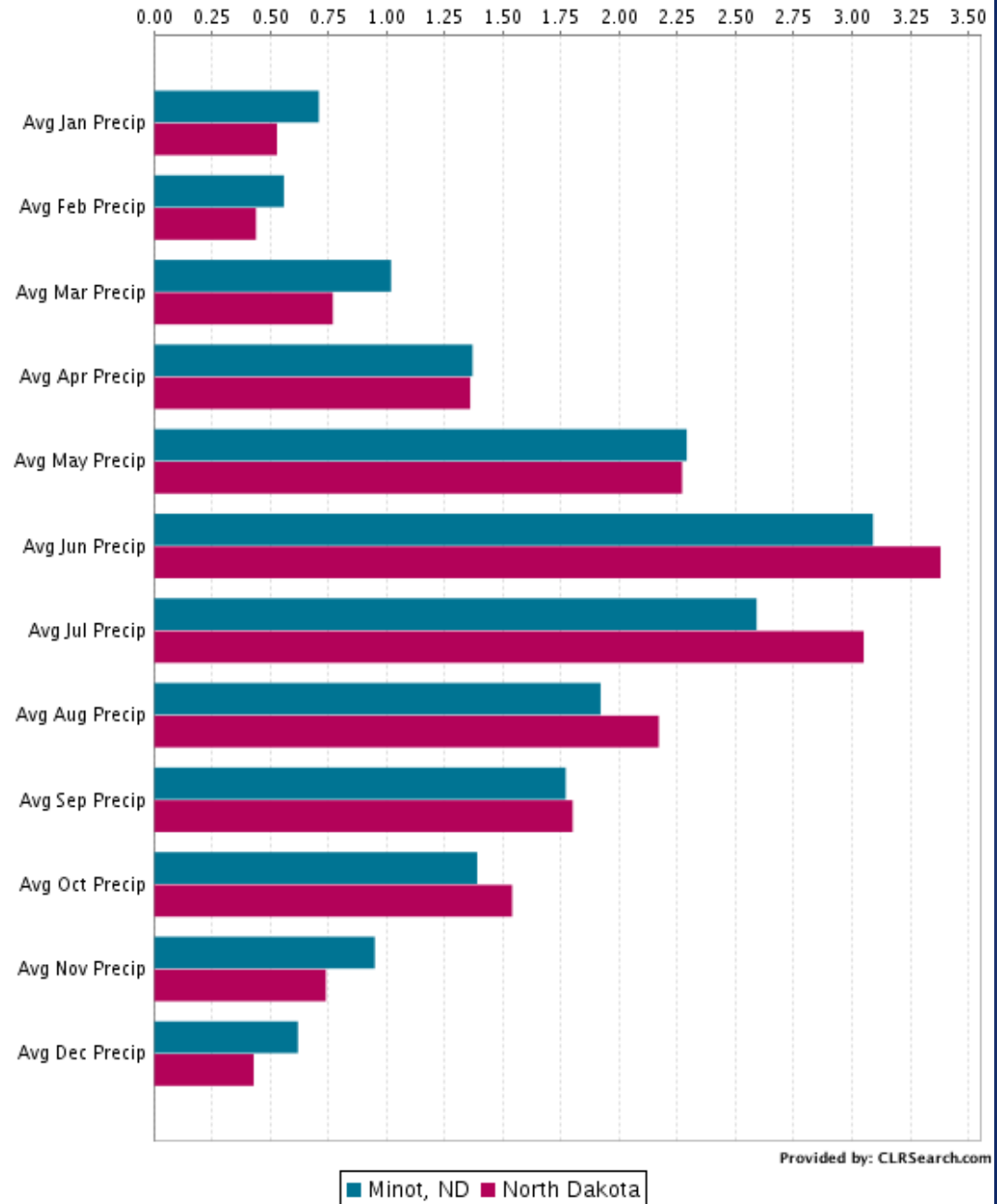




Risk Issues

- Measuring Risk is Often Difficult
- Assess Probability by the Frequency of Past Similar Events
- Rare Events are Hard to Estimate

2010 Average Monthly Precipitation for Minot, ND



Benefits of Vegetation

- Reduces Runoff Volume
- Reduces Flow Velocity
- Sediment Filtration
- Energy Absorption
- Pollution Reduction
- Soil Retention



Lake Hood

Surface Area

Hydroseed

Grass

Gravel Mulch

Hydroseed

**Larger bare areas contribute larger volumes
& greater velocities of runoff**

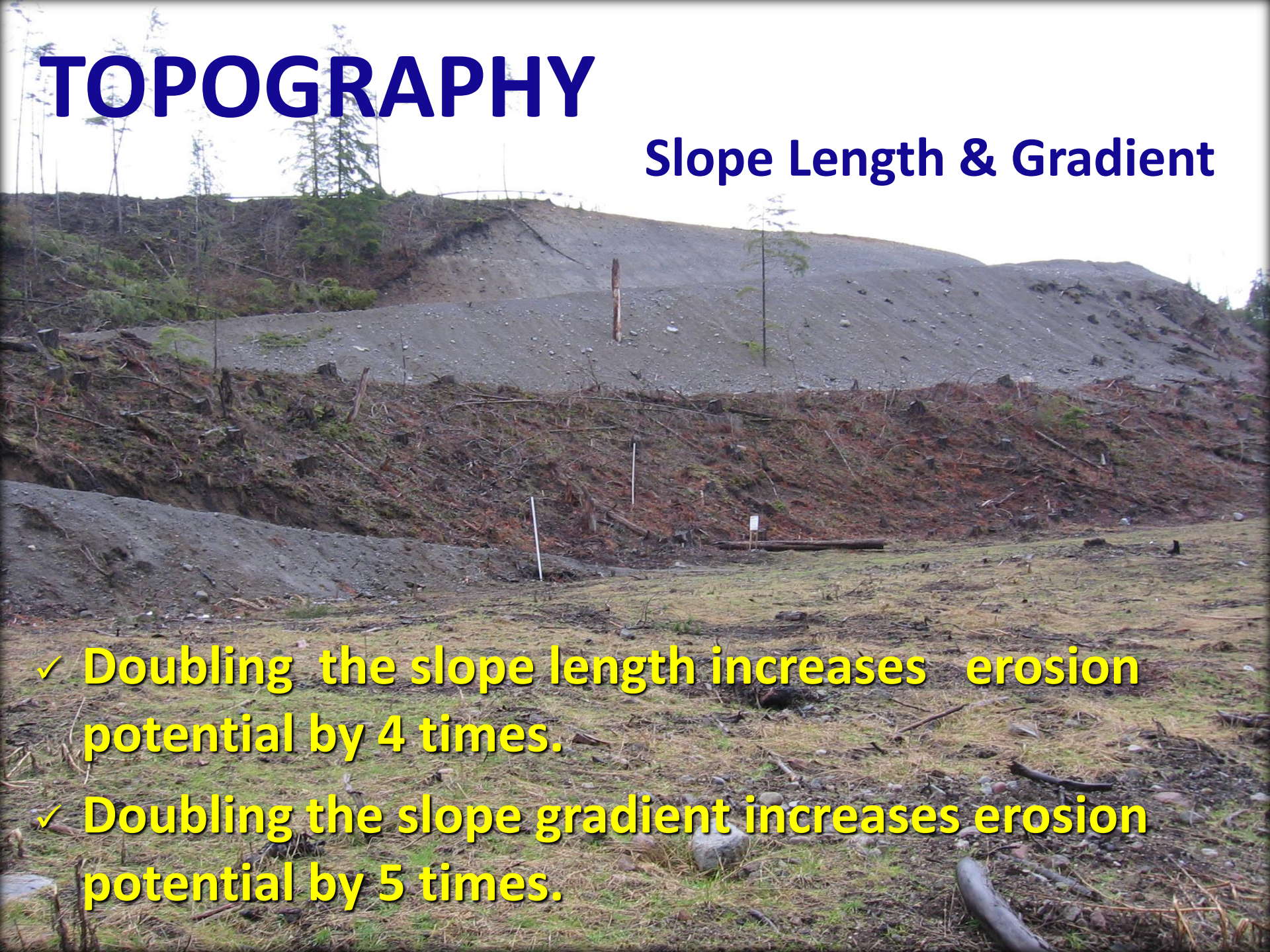
How soon can you stabilize exposed soils?



Can you take areas out of sediment production?

TOPOGRAPHY

Slope Length & Gradient

- 
- ✓ Doubling the slope length increases erosion potential by 4 times.
 - ✓ Doubling the slope gradient increases erosion potential by 5 times.

Surface Texture

Roughened Soils Reduce Erosion



Dalton Highway

Factors that Influence Erosion

Basin Area

Precipitation

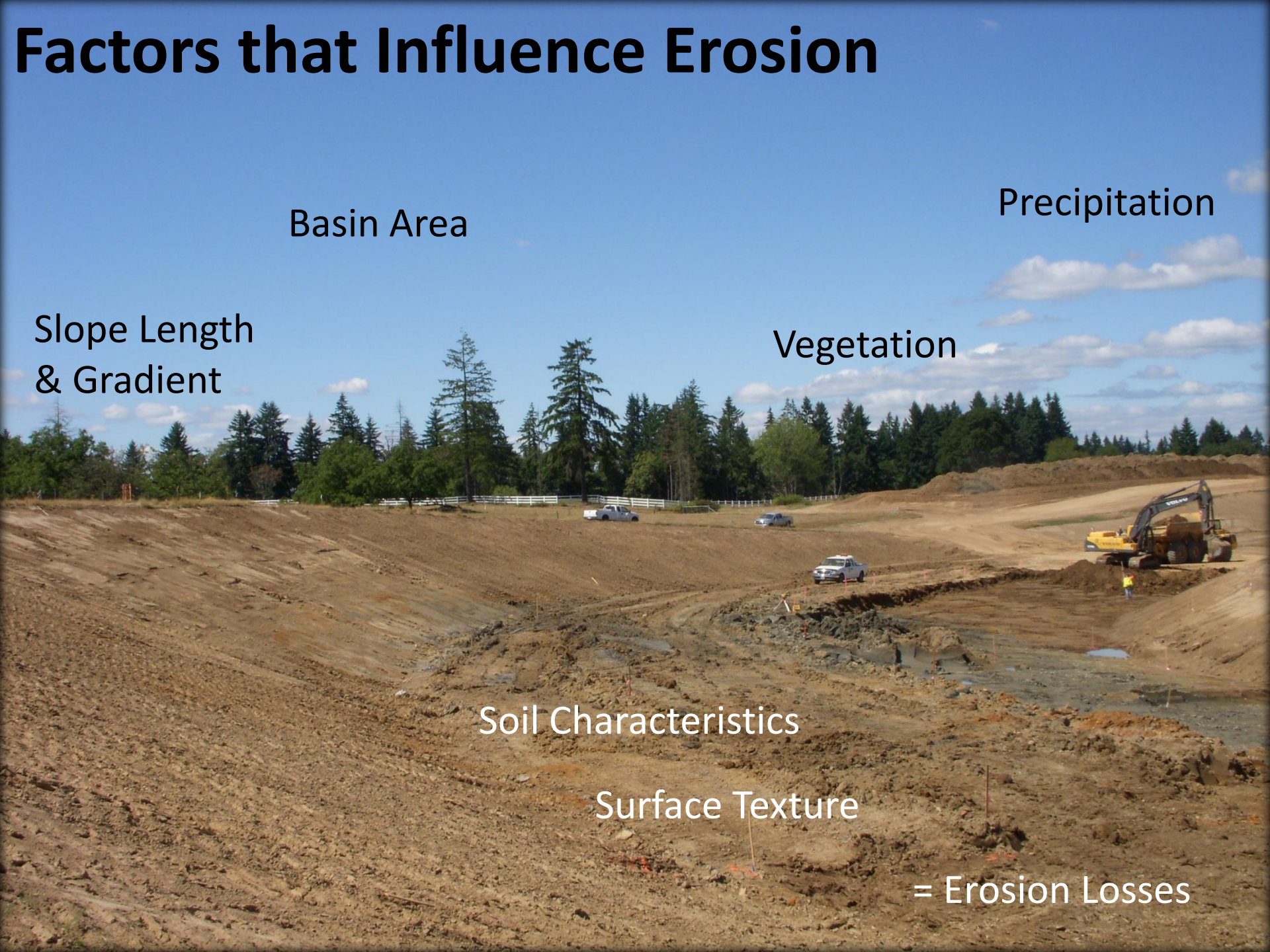
Slope Length
& Gradient

Vegetation

Soil Characteristics

Surface Texture

= Erosion Losses





Erosion Risk Assessment

How much risk does your site pose?

Consider:

- Soil type- above and below the surface
- Climate- frequency, intensity, and duration of rainfall
- Vegetation
- Surface Area
- Slope Length & Gradient
- Surface Texture

Erosion Risk Calculation Tool

Revised Universal Soil Loss Equation (R.U.S.L.E.)

$$A = R \times K \times LS \times C \times P$$

A = Annual Rate of Erosion per unit area

- R = Rainfall Factor
- K = Soil Erodiability Factor
- LS = Slope Angle & Length Factor
- C = Soil Cover Factor
- P = Conservation Practices

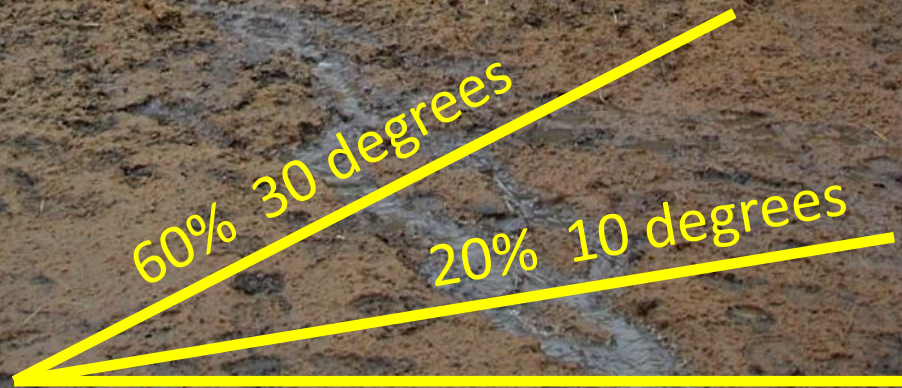
default values for LS, C, P are all 1.0



R.U.S.L.E. Example: Focus on Slope

What is the Difference in Potential Soil Loss Between 20% & 60% Slopes?

- 20% Slope (10 degrees, 4:1) 100' length, LS = 4.5
- 60% Slope (30 degrees, 1.5:1) 100' length, LS = 9.4





$$A = R \times K \times LS \times C \times P$$

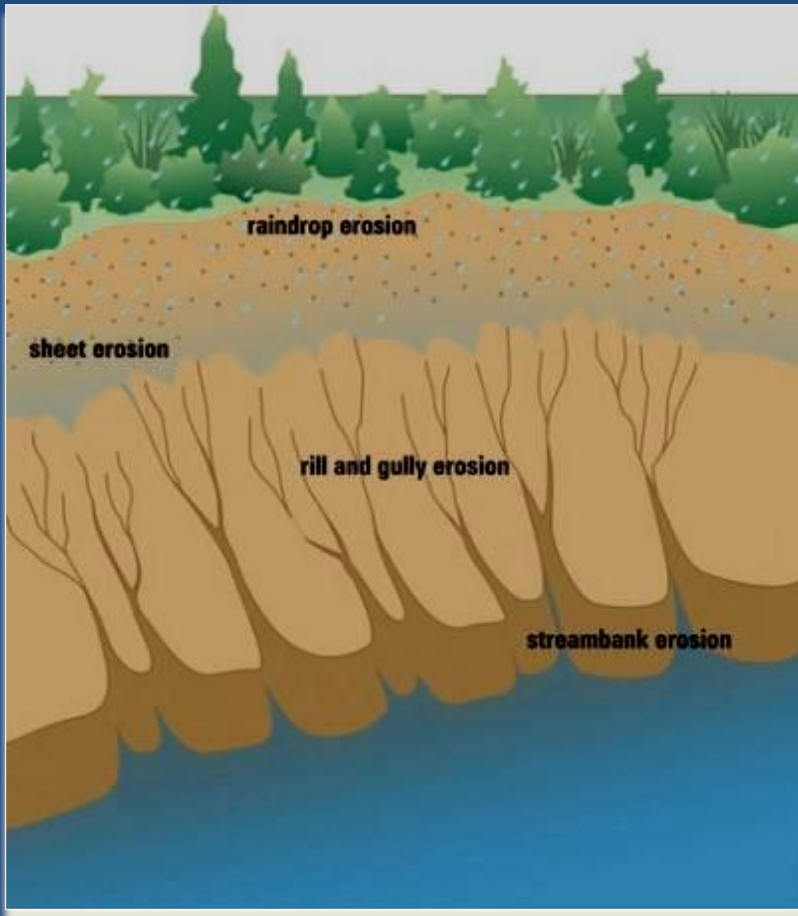
| SLOPE | A= | R | K | LS | C | P |
|-------------------------|---------------------|----|------------------------|-----|-----|-----|
| 20% 10 deg. 4:1 | 50 T/ac. | 40 | .28 (sandy loam) | 4.5 | 1.0 | 1.0 |
| 60% 30 deg. 1.5:1 | 106 T/ac. | 40 | .28 | 9.4 | 1.0 | 1.0 |

↖ **109% Increase in Soil Loss**

Note: for straw mulch, "C" factor is 0.2- how will that affect soil loss?



Prevent all types of Erosion



Raindrop erosion

Dislodging of soil particles by raindrops

Sheet erosion

The uniform removal of soil without the development of visible water channels

Rill erosion

Soil removal through the formation of concentrated runoff that creates many small channels

Gully erosion

The result of highly concentrated runoff that cuts down into the soil along the line of flow

Streambank erosion

Flowing water that erodes unstable streambanks

The background image shows a construction site under a clear blue sky. An excavator is visible in the upper left, working on a dirt embankment. A dirt road with tire tracks runs diagonally across the foreground. Trees are visible in the background on the right.

Only Three things we need to do:

1. Prevent Raindrop Erosion

- ✓ Stop the rain from hitting bare soil.

2. Prevent Rill and Gully Erosion

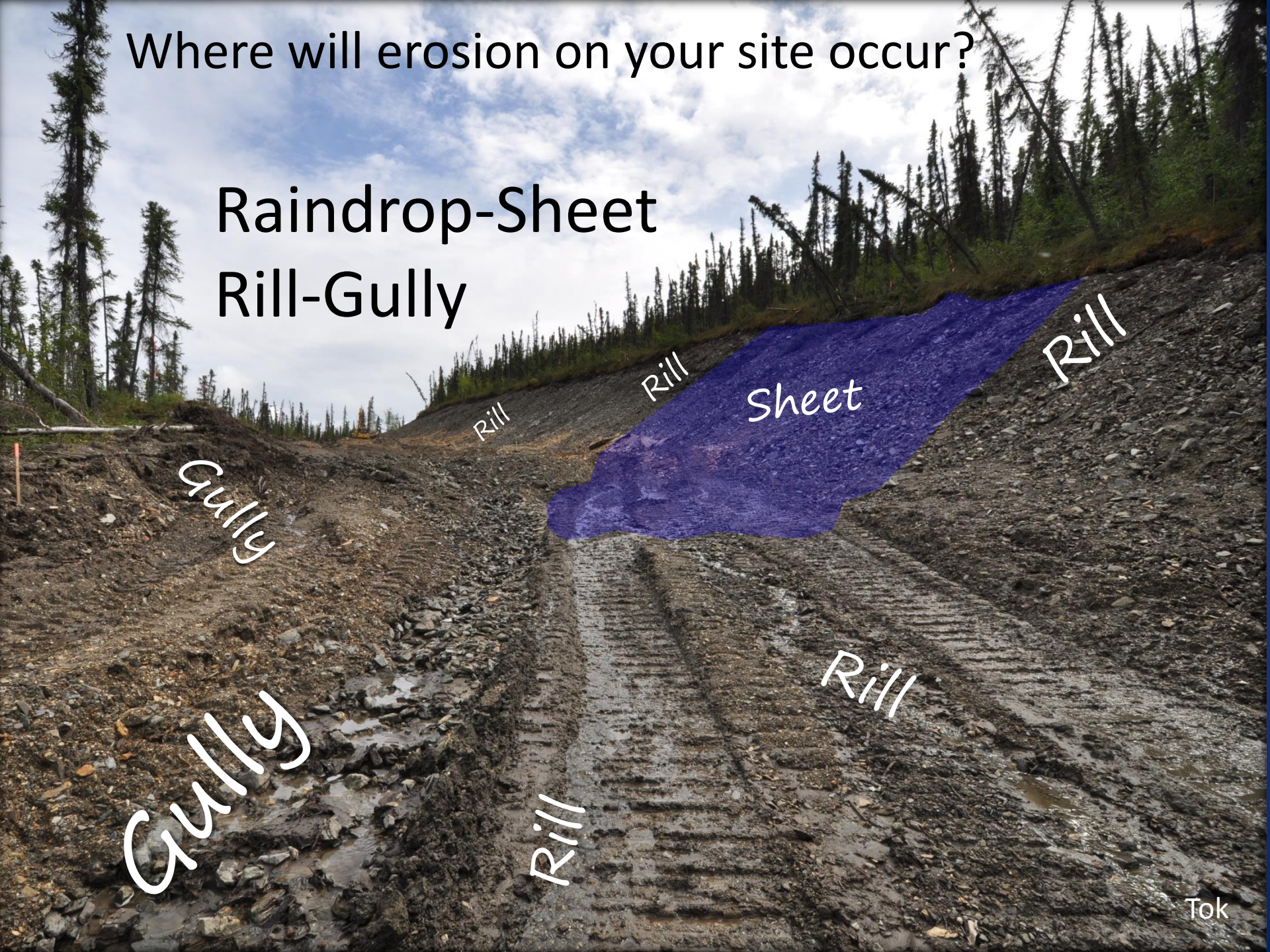
- ✓ Slow the water down.
- ✓ Armor against the flow.

3. Good Housekeeping

- ✓ Don't make extra messes.
- ✓ Clean up your messes.

Where will erosion on your site occur?

Raindrop-Sheet
Rill-Gully



What next?



Task planning BMPs for Profit

Planning for Production





Planning for Compliance















**If You're not Nervous:
Your Nuts!**

September



January





Any Less Nervous?



Seeding

Plastic

Wattles

Silt Fence

RECP's

**Preserve
Vegetation**

**Channel
Lining**

What-Where-When?

LAKE LOUISE DRIVE PLAN
A PORTION OF SECTION 16, TOWNSHIP 10 NORTH, RANGE 4 EAST
LAKEWOOD, PIERCE COUNTY, WASHINGTON

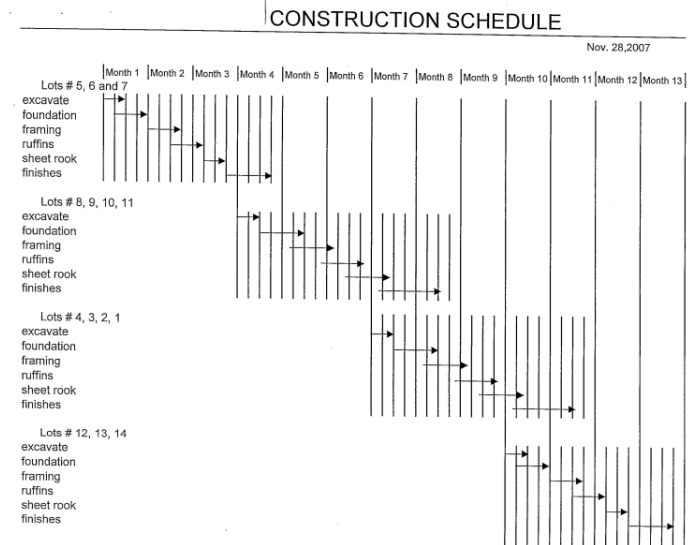
GRAPHIC SCALE
1" = 20'

UTILITY CROSSING NOTES
ALL EXISTING UTILITIES SHOWN ON THIS PLAN ARE BASED ON RECORD PLANS AND FIELD SURVEY. THE LOCATION AND DEPTH OF UTILITIES SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING ALL UTILITIES DURING CONSTRUCTION. IF ANY UTILITIES ARE FOUND TO BE DEEPER THAN INDICATED, THE CONTRACTOR SHALL STOP WORK AND NOTIFY THE ENGINEER IMMEDIATELY.

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Scheduling & Phasing

← Creek



MEANS & METHODS



Its about how you do,
what you do,
and when you do it

How do you do what you do?

Are your means and methods compliant with permit conditions?





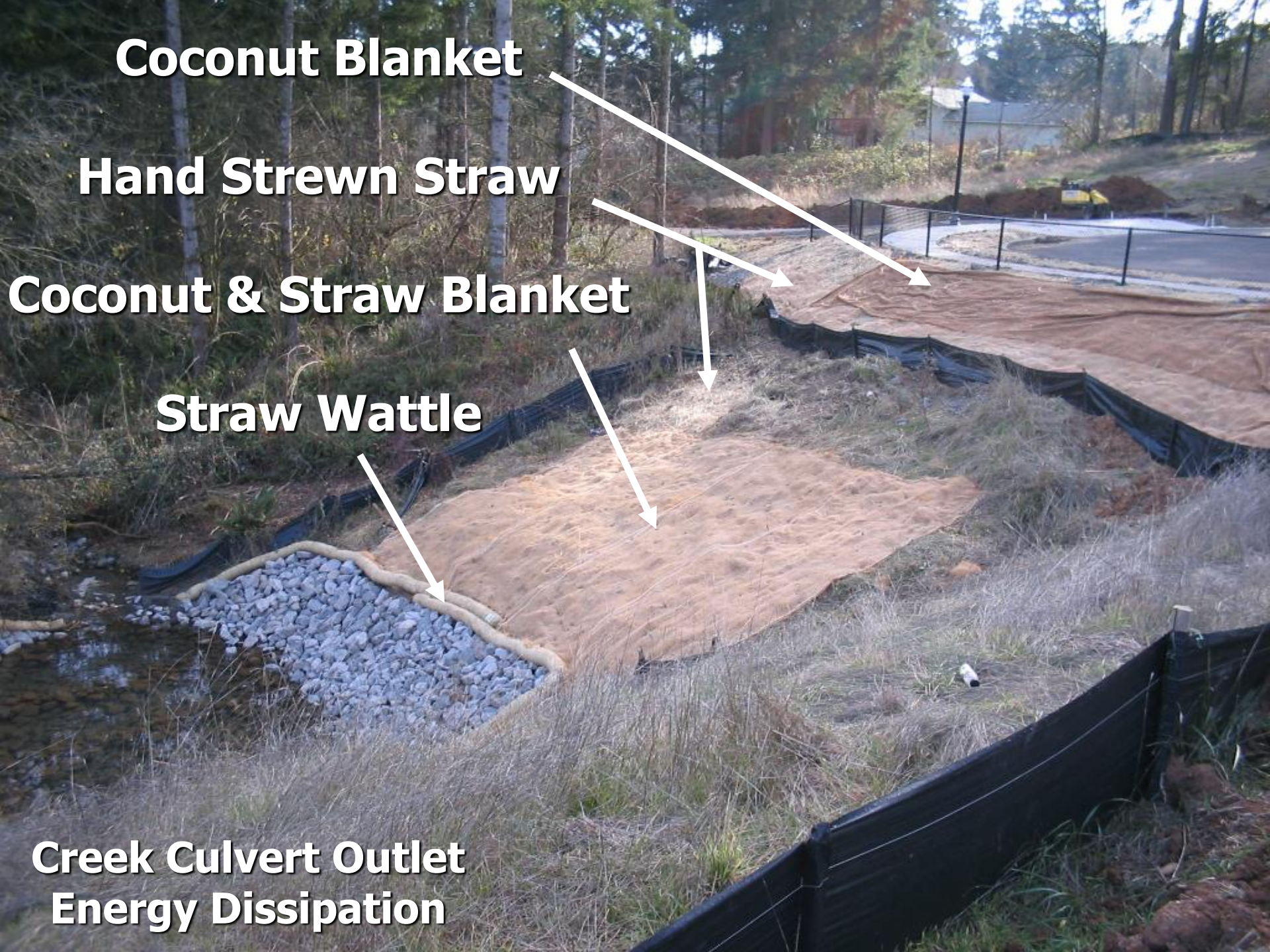
Coconut Blanket

Hand Strewn Straw

Coconut & Straw Blanket

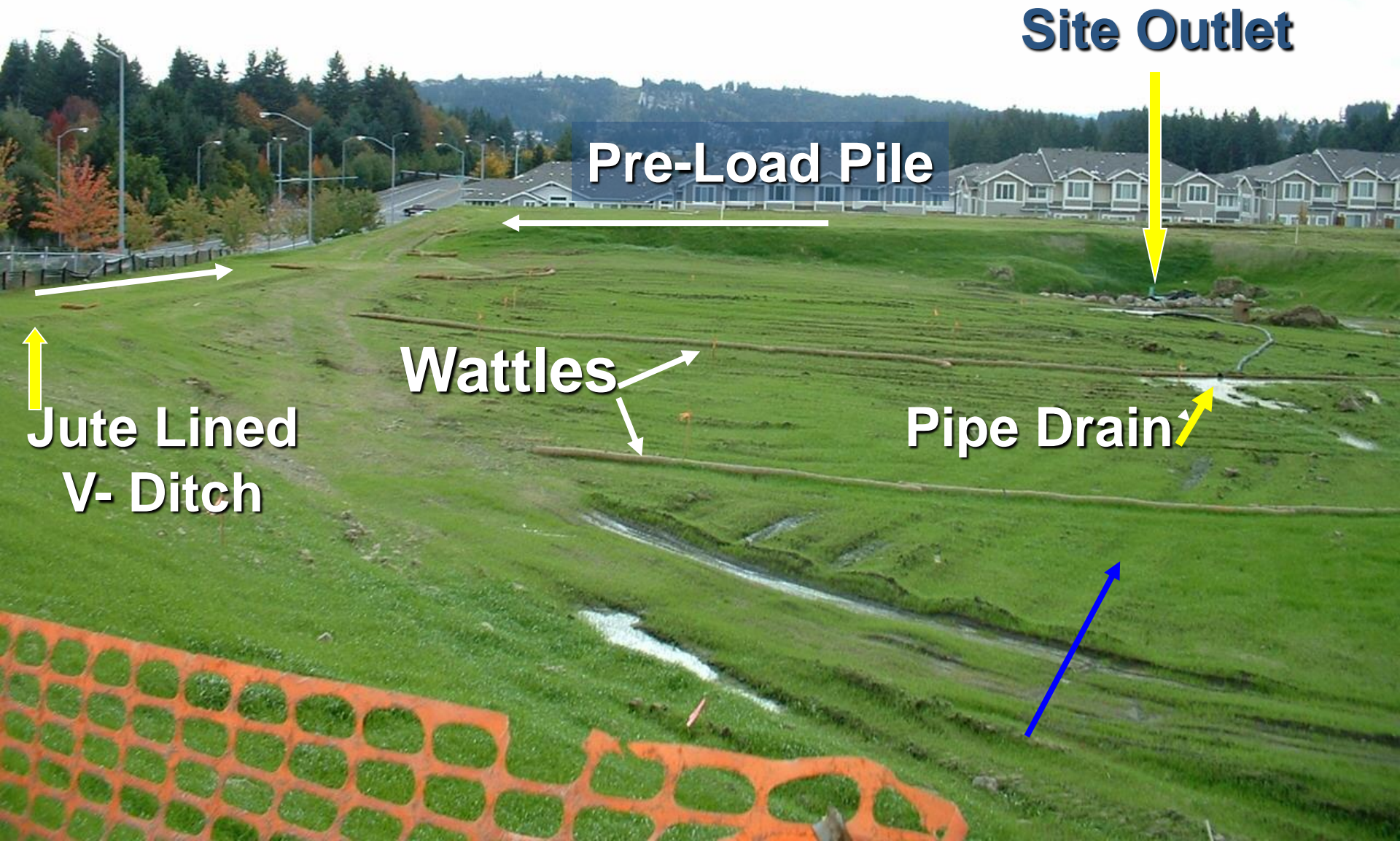
Straw Wattle

**Creek Culvert Outlet
Energy Dissipation**



- 
- ✓ **Stockpile Covered**
 - ✓ **Stockpile Silt Fence, Reinforced**
 - ✓ **Lot Grading Perimeter Silt Fence**
 - ✓ **Buffer Zone**
 - ✓ **Wire Backed Silt Fence at Site Perimeter**

Temporary “Winter Over” Erosion Control





Straw Wattles

- Reduce water velocity
- Spread the flow of rill and sheet runoff
- Capture and retain sediment
- Placed in shallow trenches and staked on contour



BMP
WA C-235
OR SC-7
AK - 8

Glenn Hwy

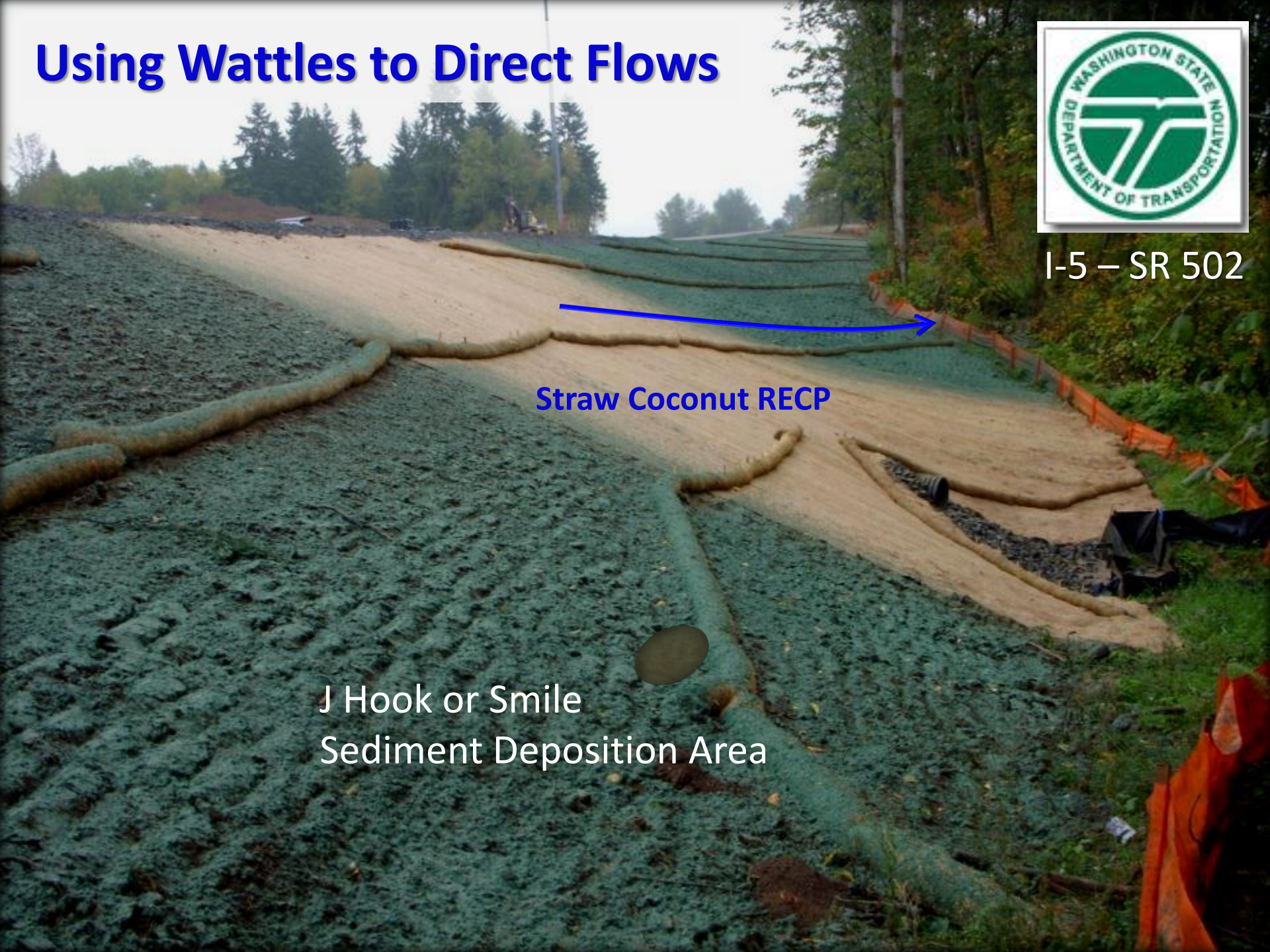
Using Wattles to Direct Flows



I-5 – SR 502

Straw Coconut RECP

J Hook or Smile
Sediment Deposition Area



Direct flows off slopes



I-5 — SR 502



Ketchikan

Cut Slope Stabilization
Finish as you go!

Communicate Your Plan to Everyone With Access to Your Site



Scheduling

Stabilized Site

**BMP
WA C-162
OR EP-1**

Bonneville Dam

All Sites Require Multiple BMP's

Compost Sock

Creek

Coir Blanket

Silt Fence

Coir Logs

Seeding

Jute Netting

The trick is...

The right BMP,

in the right place, at the right time!

Gravel Access



Silt Fence



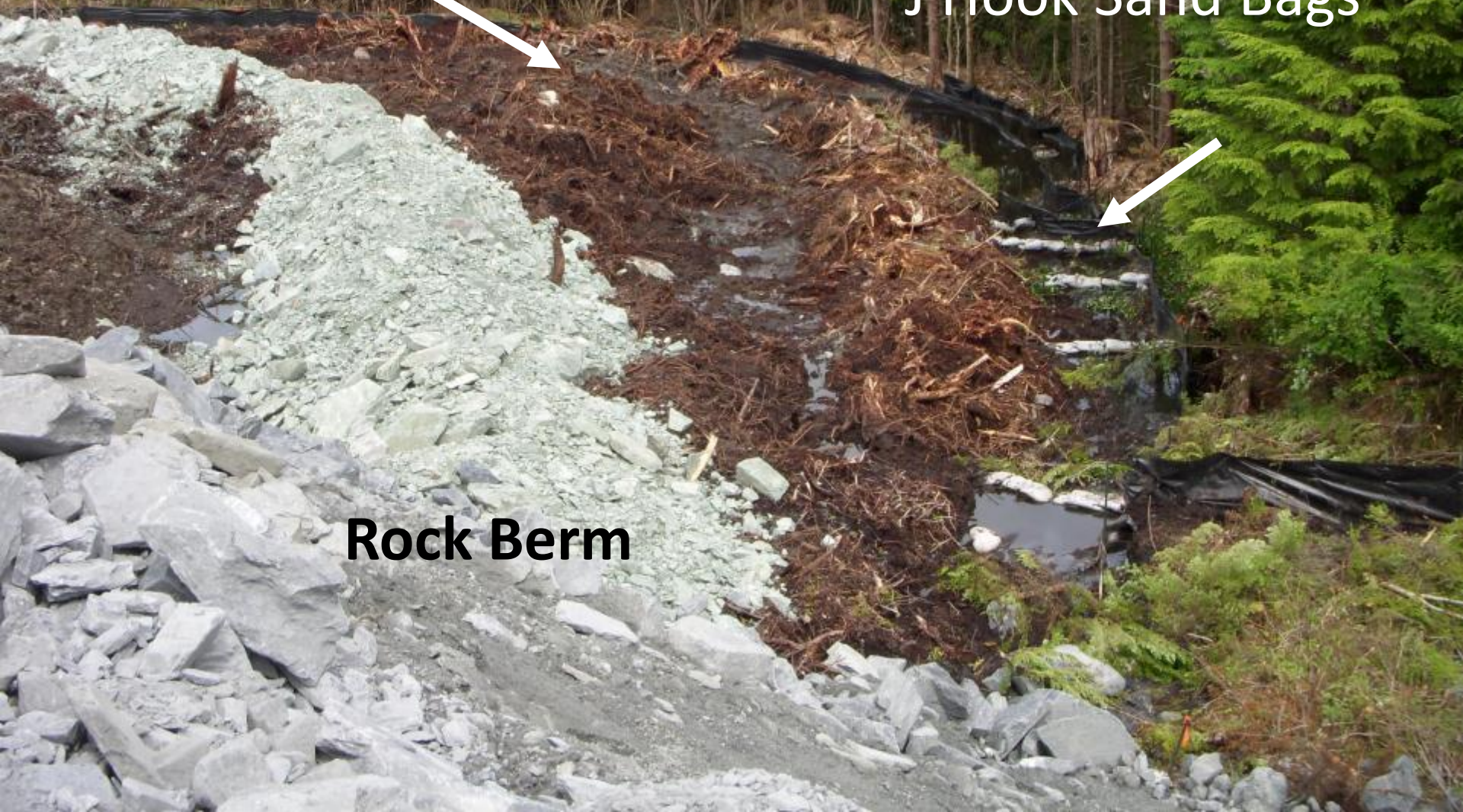
Slash Berm



J Hook Sand Bags



Rock Berm



Plan Ahead



Avoid preparing for spring
runoff the hard way!



VOYAGER LE

SILT HAPPENS

Focus on the Details That Matter....



An aerial photograph of a city, likely Florence, Italy, showing the Arno River winding through the urban landscape. In the background, a large, snow-capped mountain (Monte Cimino) rises above the city. The sky is filled with soft, white clouds, and the overall lighting suggests a hazy or overcast day.

"We know more about the movement of celestial bodies than about the soil underfoot."

-1452-1519

-Mathematician, Artist

-Inventor, Engineer

-The Last Supper

-Mona Lisa

-Leonardo Da Vinci



Doing It Right Won't Kill You !



Innovation from the front lines

Dalton Highway

Be on the lookout for
Cost Saving Opportunities

Cutting Edge BMP Removal Strategies

Free Acquisition
Of Materials

64 BUILDING MATERIALS

9X14 ALUMAWOOD
PATIO COVER
W/ 4 SKYLIGHTS, \$2000.
904-3096

9X14 ALUMINUM
PATIO COVER
W/ 4 SKYLIGHTS, \$700.
904-3096

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FACTORIES OUTLET**
Factory Overstocks,
Duplicates & Returns
For: Kitchen • Bath • Laundry
8-6 Mon. - Fri., 8-4 Sat.
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555-241-1554

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erosion control construction
fence. You remove.
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68 CLOTHING

Cherry
Hand craft
hardwood
(New \$475)
360-859-

FULL size ad
form w/ temp
length matt
2 month
Paid over \$
\$900/obo.

GOP
11 Piece
Living Room
new! \$2500
Call for d
360-2

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BRAND**
Double
Still in plas
Can deliver.

Maple kitche
Dining table
Entertainmen
ror; Cherry l
queen bed; 3-
free/no pets

MA
SOFA &
Bed w/ gray
\$450.

Mic
Sofa &
\$499 Brand
crates. Lif
Condition

Common Problems.....



Look for the signs

Solutions

Right Way

